AN INTRODUCTION TO THE GEOLOGY

OF

FRANKLIN COUNTY

A Thesis

Presented in Partial Fulfillment of the Requirements

for the Degree Bachelor of Science

By

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ACKNOWLEDGMENTS

I thank Dr. Garry D. McKenzie, Professor of Geology, for his guidance and assistance in the preparation of this report and Dr. Stigmund M. Bergström, Professor of Geology and Curator of the Orton Museum, for information on museum specimens and fossil collecting localities in Franklin County.

INTRODUCTION

The purpose of this report is to provide a general overview of Franklin County's geologic past suitable for the beginning student or those not intimately familiar with this area. It is also submitted for possible condensation to pamphlet or leaflet form to serve as a visitor's reference to the geology of Franklin County.

Several reports dealing with one aspect or another of the geology of the area have been written, but few recent, all-encompassing works. The reason for this may be in the fact that Franklin County has not been productive in the search for fossil fuels, which has been the spark for extensive interest and research in many counties of eastern Ohio. The intent here is to draw together several of these diversified accounts into a somewhat brief but coherent and tangible form.

GENERAL PHYSIOGRAPHIC DESCRIPTION

Franklin County, Ohio lies directly in the center of the state. It is bordered by Delaware County to the north, Union County to the northwest, Madison County to the west, Pickaway County to the south, Fairfield County to the southeast and Licking County to the east. (Fig. 1).

It occupies a total area of 343,680 acres or 535 square miles. This is an area of very little relief, owing to glacial erosion and deposition. Till deposition was so evenly and equally distributed as to leave the entire area remarkably flat. The topography has been only moderately incised by post-glacial erosion. Elevations range from a high of 1,130 ft. in the extreme northeastern corner, to a low of 670 ft. where the Scioto River enters Pickaway County to the south. Franklin County ranks among the most highly urbanized counties in the state. In 1970 the total population was 833,249 of which over 95% was classified as urban.

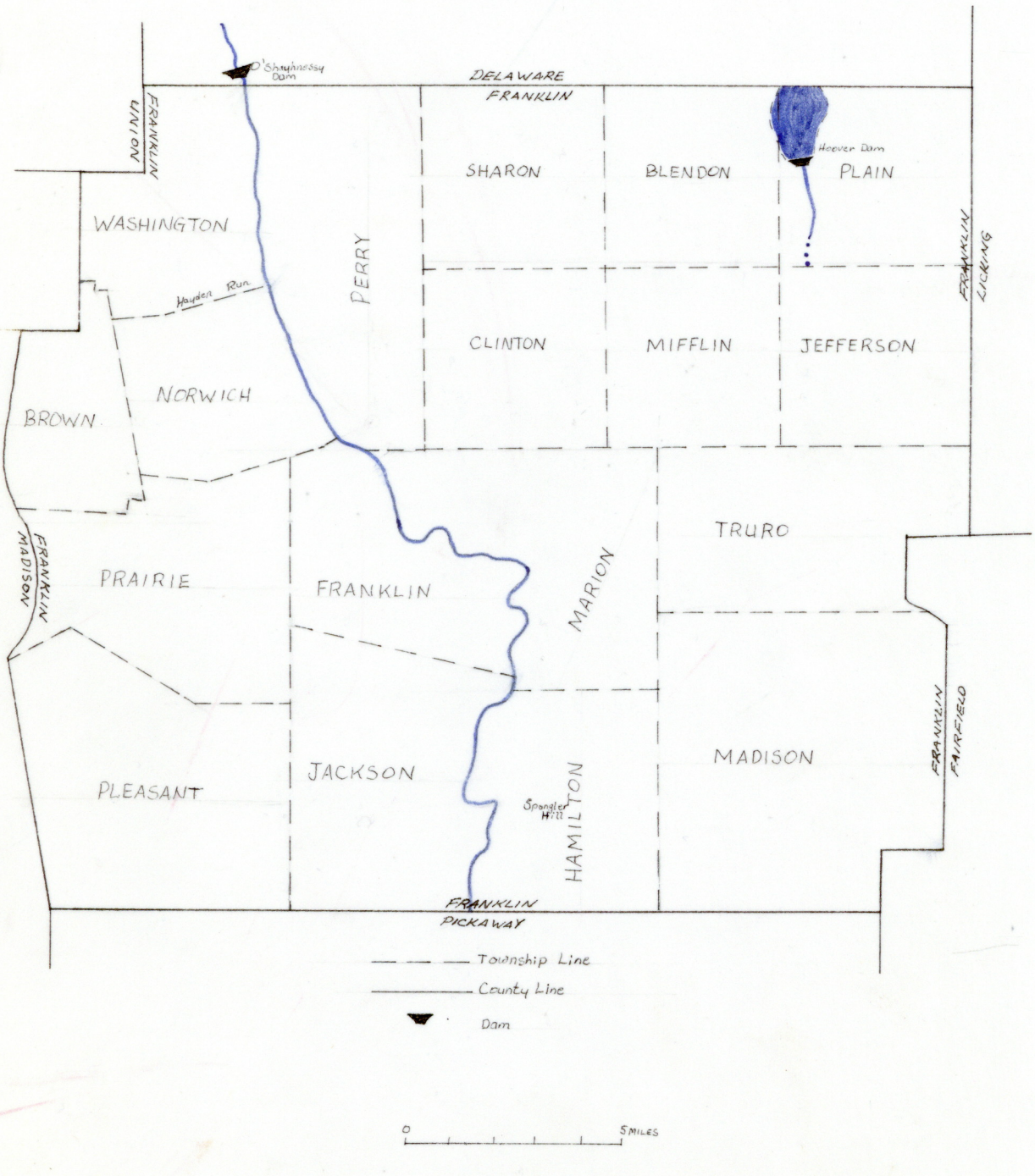


FIG No 1 A TOWNSHIP MAP OF FRANKLIN COUNTY
(ADAPTED FROM TOPOG. MAP U.S.G.S. 1912)

BEDROCK GEOLOGY

INTRODUCTION

The great majority of bedrock exposed here is Devonian in age (Fig. 2). A very small sliver of Silurian rock crops out on the far western edge and a little Mississippian to the northeast. Therefore this report will be concerned primarily with Devonian bedrock.

Bedrock of Silurian age in Franklin County used to be referred to as the "Monroe Formation" (Stauffer et al., 1911). That name is no longer in use and today these rocks can only be designated as "Salina Group undifferentiated" or "Bass Island Group undifferentiated". The latter name is actually Michigan terminology which may not be applicable to this portion of Silurian bedrock in Ohio (per. comm., D. Stith). So a degree of confusion does exist regarding the stratigraphic nomenclature.

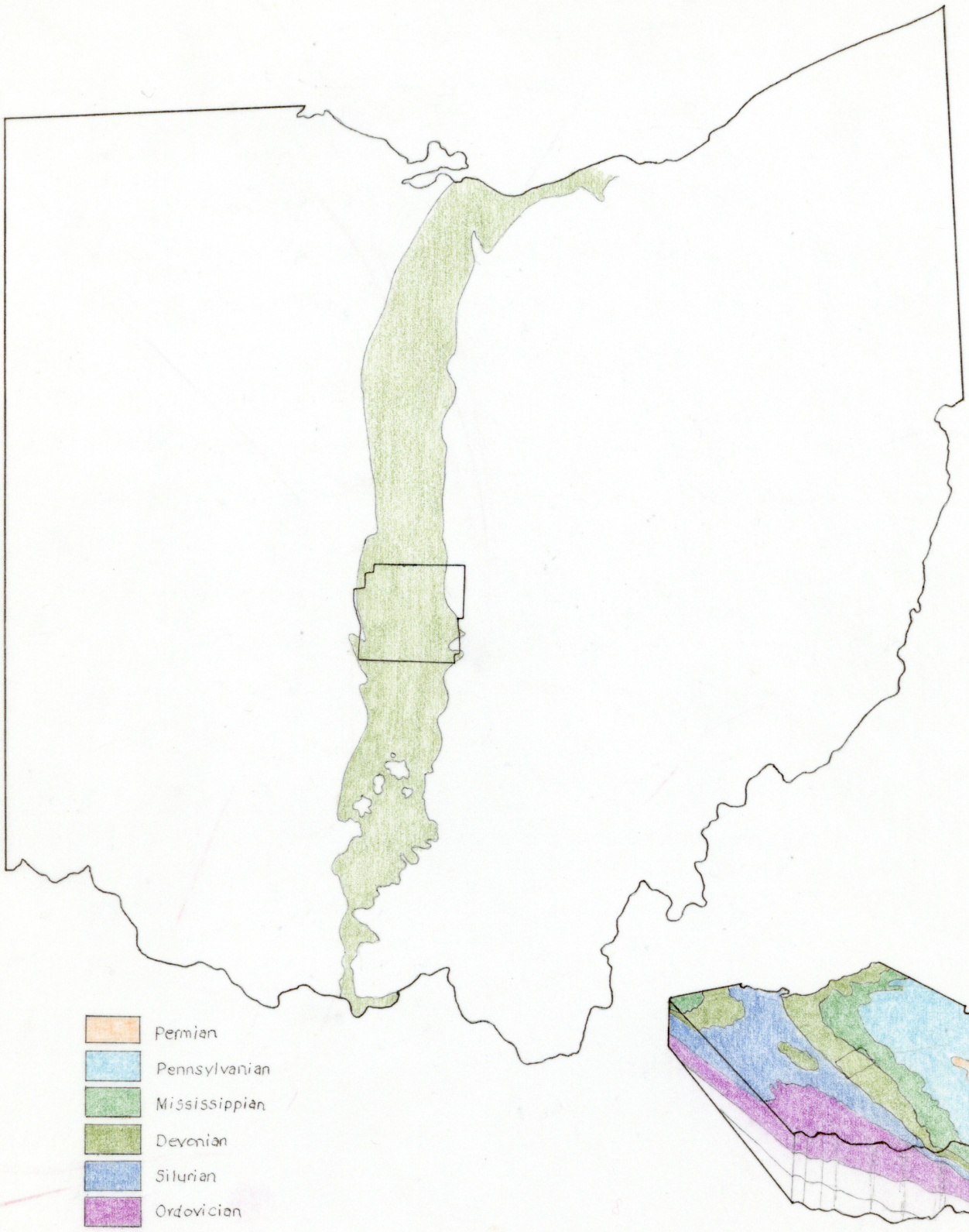


FIGURE NO. 2 A. EXPOSURE OF DEVONIAN BEDROCK THROUGH CENTRAL OHIO (AFTER O.D.N.R. EDUC. LEAFLET NO. 8, H.R. COLLINS 1975)

FIGURE NO 2 B. EXPOSURE OF BEDROCK ACROSS OHIO

PALEOZOIC DEPOSITIONAL HISTORY

Kovach and Baker, in their 1966 report prepared for the Comprehensive Regional Plan, provide a handy summary of the Paleozoic depositional history of the bedrock exposed in Franklin County, the essence of which follows.

The bedrock exposed in Franklin County was formed in the Paleozoic Era at a time when central Ohio was covered by a shallow inland sea. Calcareous muds deposited in this sea were later compacted and hardened to become the limestones and dolomites of the Silurian and Devonian. Clays and sands deposited in the muddy seas became the Devonian shales and Mississippian sandstones and shales. None of the bedrock exposed in Franklin County is younger than Paleozoic. No record of subsequent rock deposition from late Paleozoic to the Quaternary exists. Any that may have been deposited were since eroded. This represents a gap of over 320 million years in the depositional record, an unconformity of considerable magnitude.

Lithologic descriptions of bedrock formations in Franklin County are given below, by period, from oldest to youngest. A brief summary of the units is given in Table 1.

LITHOLOGIC DESCRIPTIONS

"Monroe Formation" [Upper Silurian (Bass Island Group undifferentiated or Salina Group undifferentiated)] - The Monroe may best be equated to the Bass Island Group undifferentiated (Stith). The Bass Island Group consists of four formations: the Greenfield, Tymochtee, Put-in-Bay and Raisin River. All are dolomites. As a whole, the group has been described as argillaceous, bluish-gray to light brown, banded, commonly with solution channels and a generally porous texture (Kovach, 1966). These last two attributes make the Bass Island Group an important source of ground water in other parts of the state.

Columbus Limestone (Lower Devonian) - The Columbus Limestone lies unconformably upon the Bass Island Group. The average thickness is about 105 ft. (following lithologic description is from Stauffer et al., 1911):

lower 40 ft. - . . .brown magnesian limestone with bituminous matter, slightly banded, wavy structure. It consists of massive beds with small masses of chert and calcite pockets. Fossils are rare in this portion as they have been destroyed by dolomitization.

upper 65 ft. - . . .highly calcareous, very fossiliferous, evenly bedded but bedding planes appear uneven due to ripple marks.

uppermost 6-8 in. - . . .called "bone bed". Millions of fish teeth and plates lie piled in excellent preservational state. Overall the Columbus Limestone is noted for its thickness, purity and economic importance. Vertical joints in the rock have widened by dissolution to form sinkholes.

These have been used advantageously by blasting during quarrying. The Columbus Limestone is exposed in a north-south trending belt of up to 25 miles in width.

Delaware Limestone (Devonian) - The distribution of this formation parallels that of the Columbus. It ranges from 30 to 70 feet in thickness. The composition of the Delaware ranges from a massive bluish-gray, impure limestone to an interbedded shale with limestone and black chert. Its bedding is usually uneven with beds being 2 to 24 inches thick. Pyrite nodules occur in the upper portion.

Olentangy shale (Devonian) - The Olentangy is a bluish-gray to greenish-gray argillaceous shale with black fissile shale beds in the upper portion. Pyrite nodules are common in this formation. These deposits are transitional between the limestones below and the clastics which follow. Even so, the contact between the Olentangy and Delaware formations may be quite sharp (Stauffer, 1911). The average thickness in central Ohio is about 35 feet.

Ohio Shale (Upper Devonian) - This is the last of the Devonian formations in central Ohio. A fresh surface reveals this shale to be brownish or bluish-black in color and somewhat sandy. The laminae break into fissile pieces and weather to a brownish clay. This color is due to the abundance of iron pyrites. Large iron-stone concretions, which may exceed six feet in diameter, characterize the Ohio Shale. (Recent roadwork at the Delaware-Worthington exit from I-270 has revealed several of these huge concretions.) The average thickness of this formation in Franklin County is about 450 feet. Elsewhere in the state, the Ohio Shale is the

principal oil-bearing shale. The Ohio outcrops or subcrops in a belt of up to 20 miles in width.

Bedford Shale (Mississippian) - The Bedford Shale is the oldest of the Mississippian formations exposed in Franklin County. Anderson and King describe it as: . . ."a gray and blue-gray shale with nodular light gray mudstone and brownish-gray to gray irregularly bedded siltstone". The Bedford grades upward into thin sandstone layers. The thickness of this formation in Franklin County is about 75 feet.

Berea Sandstone (Mississippian) - The Berea is a medium to fine grained gray quartz sandstone with small amounts of iron, aluminum and lime-bearing compounds, bedding is heavy to massive. The average thickness here is about 50 feet.

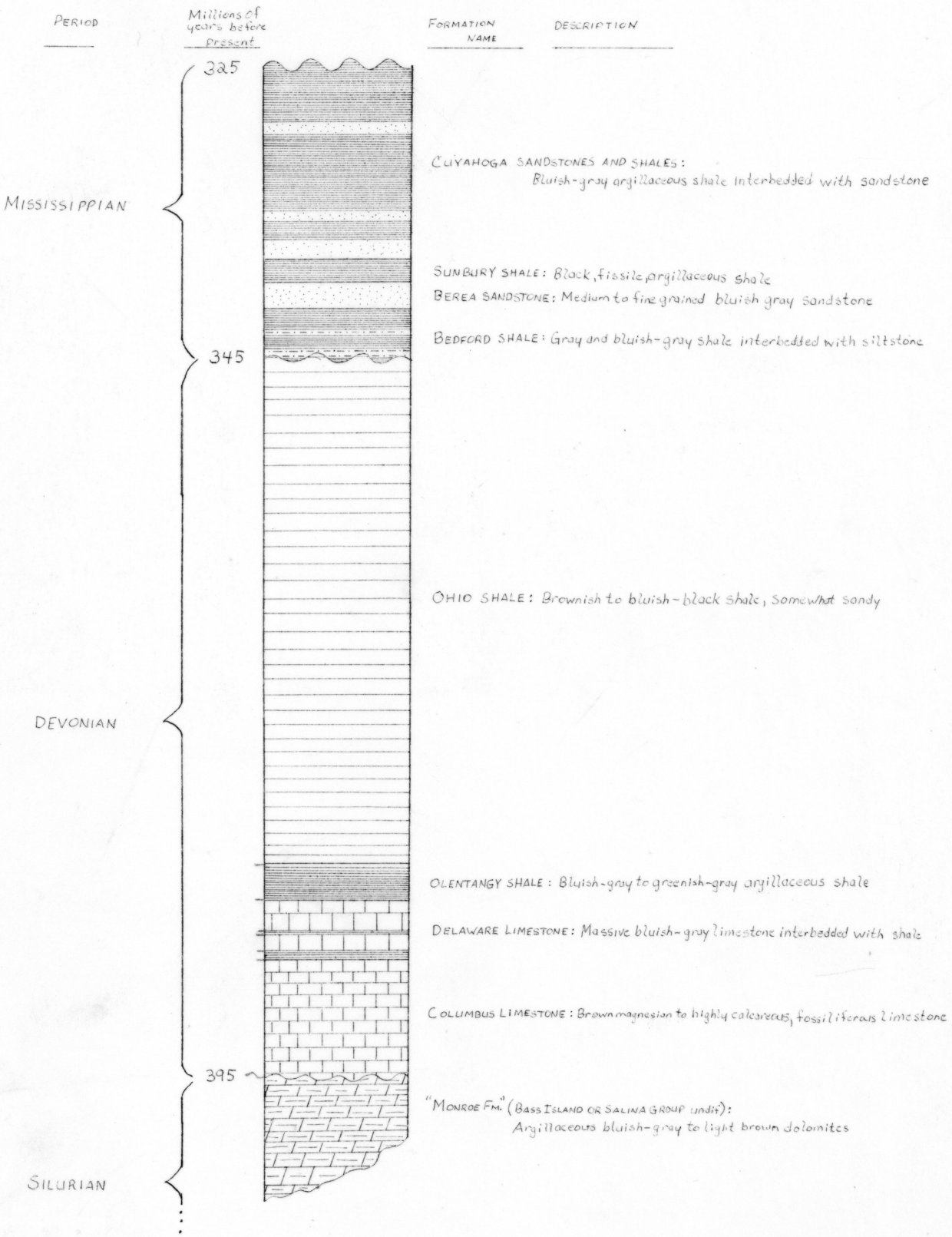
Sunbury Shale (Mississippian) - This is a black, fissile, argillaceous shale with much carbonaceous material. It can resemble the Ohio Shale in appearance but is less resistant, thinner bedded and more fissile. Its maximum thickness in Franklin County is 36 feet.

Cuyahoga Sandstones and Shales (Mississippian) - This is the youngest outcropping formation in the county. It is a bluish-gray, argillaceous shale grading upward into a fine grained sandstone alternating with more bluish shales. The maximum thickness in the county is around 300 feet.

Figure 4 is a generalized cross section through Columbus and Franklin County from west to east. The vertical scale has been exaggerated to show the slight eastward dip.

TABLE 1 GEOLOGIC COLUMN OF FRANKLIN COUNTY BEDROCK

(RADIOMETRIC DATES AFTER McALESTER 1968) UNIT THICKNESSES ARE RELATIVE TO ONE ANOTHER



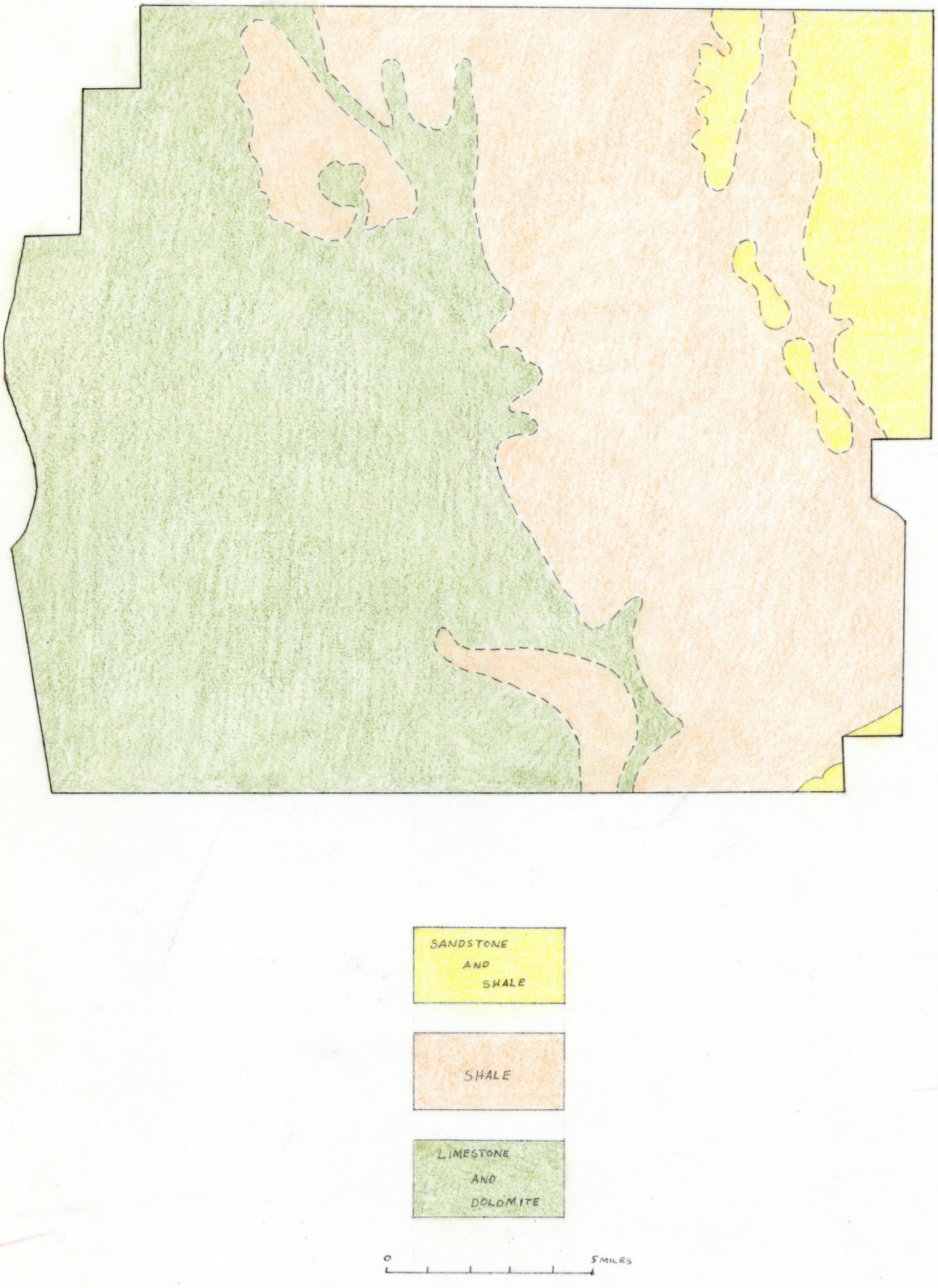


FIGURE NO. 3 MAP OF FRANKLIN COUNTY, OHIO SHOWING DISTRIBUTION OF BEDROCK LITHOLOGIES (AFTER BATES, 1973, unpublished)

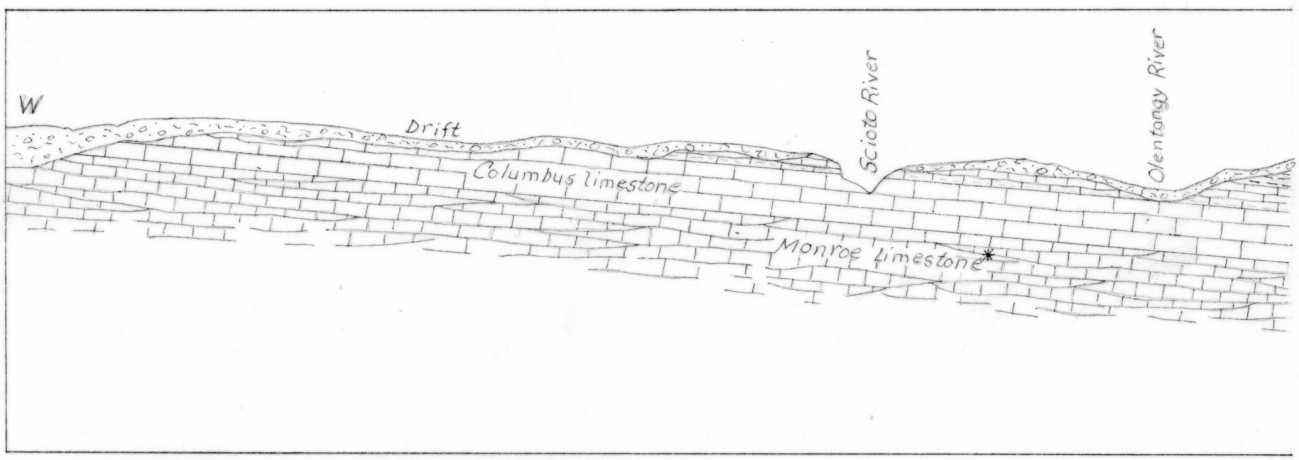
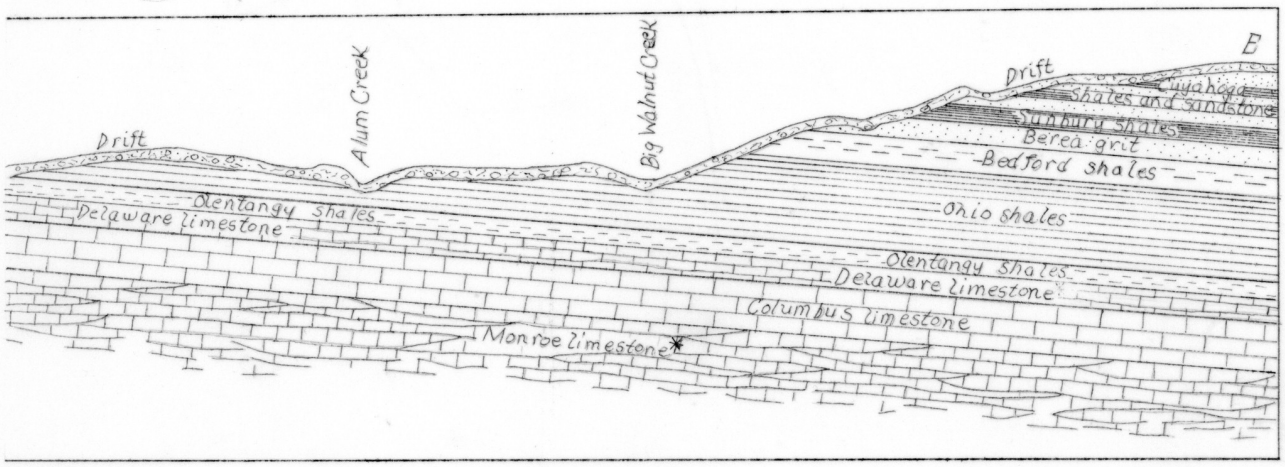


FIGURE NO. 4 A CROSS SECTION THROUGH COLUMBUS AND FRANKLIN COUNTY, OHIO FROM WEST TO EAST SHOWING A PORTION OF THE BEDROCK. HORIZ. SCALE 1"=2 MILES ; VERT SCALE 1"-660 FEET (FROM STAUFFER ET AL. 1911)



* THIS IS AN OLD NAME FOR UPPER SILURIAN STRATA WHICH TODAY CAN ONLY BE REFERRED TO AS "BASS ISLAND GROUP (undif.)" (PERSONAL COMMUNICATION WITH DAVE STITH, DIV. GEOL. SURV., 10/16/79)

FOSSILS

DEVONIAN FOSSILS

As mentioned, the great majority of bedrock exposed in Franklin County is Devonian. Therefore, this portion of the report will focus on fossils of that age. Fossils of other periods are not described here, but the reader is referred to La Rocque and Marple (1977) for this information.

During the early Devonian, Ohio was land. When the Middle Devonian seas invaded Ohio, many different types of marine organisms were introduced from the south, north and northwest. Devonian seas were shallow, warm and relatively clear. Corals flourished in this environment and deposited their skeletons in great coral reefs, which today are preserved in Devonian limestones.

The Devonian is often called "The Age of Fishes", due not necessarily to the abundance of individuals, but rather to the important evolutionary changes and diversification which took place during that time. In this period, invertebrate animals far outnumbered vertebrates, which is why they are so much better represented in our fossil record.

Devonian rocks in Franklin County consist of four formations; the Columbus and Delaware Limestones and the Olentangy and Ohio Shales.

Several thin "bone beds" occur in Devonian limestones. These are layers of unusually heavy fossil accumulations and generally range in thickness from a few inches to as much as a foot. They are packed with fish

bones, scales, teeth, spines, foraminifers, scolecodonts, ostracodes and plant spores. A couple of hypotheses have been raised to explain the high concentrations of organic material in these layers. One suggests that they represent times of widespread destruction of marine life due to some catastrophic event, such as volcanic activity (Stauffer et al., 1911). Another states that normal accumulations of organic debris, perhaps several feet thick, have been reduced by gentle wave action carrying away the mud fraction, thus concentrating the heavier organic portion (La Rocque and Marple, 1977).

One of the more famous bone beds appears in the upper six inches of the Columbus Limestone. Although they are commonly only local in occurrence, this particular bed has been mapped from south of Franklin County, and through it, to as far north as Sandusky, Ohio in Erie County. Another appears 25 feet above the base of the Delaware Limestone and is packed with specimens of Hadrophyllum d'orbignyi, the "button coral". Illustrations of this and other invertebrate fossils are given in Figures 5 to 9. Figures 1A to 24E are from Stauffer, Hubbard and Bownocker (1911). Figures 25E to 26E are from Moore, Lalicker and Fischer (1952).

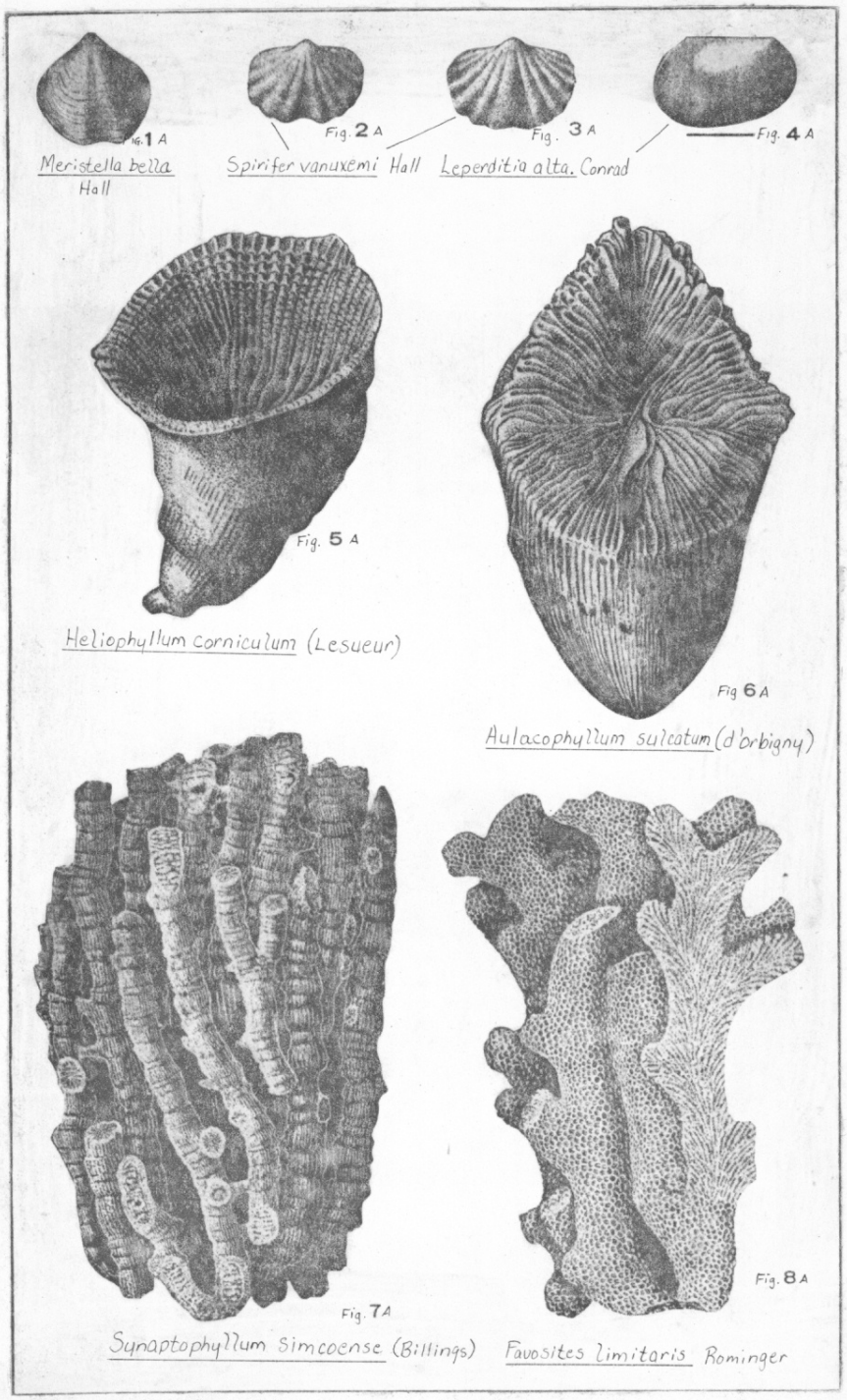


FIG. No. 5 "MONROE" AND COLUMBUS LIMESTONE FOSSILS

Figs. 1A-3A are brachiopods and Fig. 4A is a crustacean, all from the "Monroe"

Figs. 5A-8A are corals of the Columbus Limestone

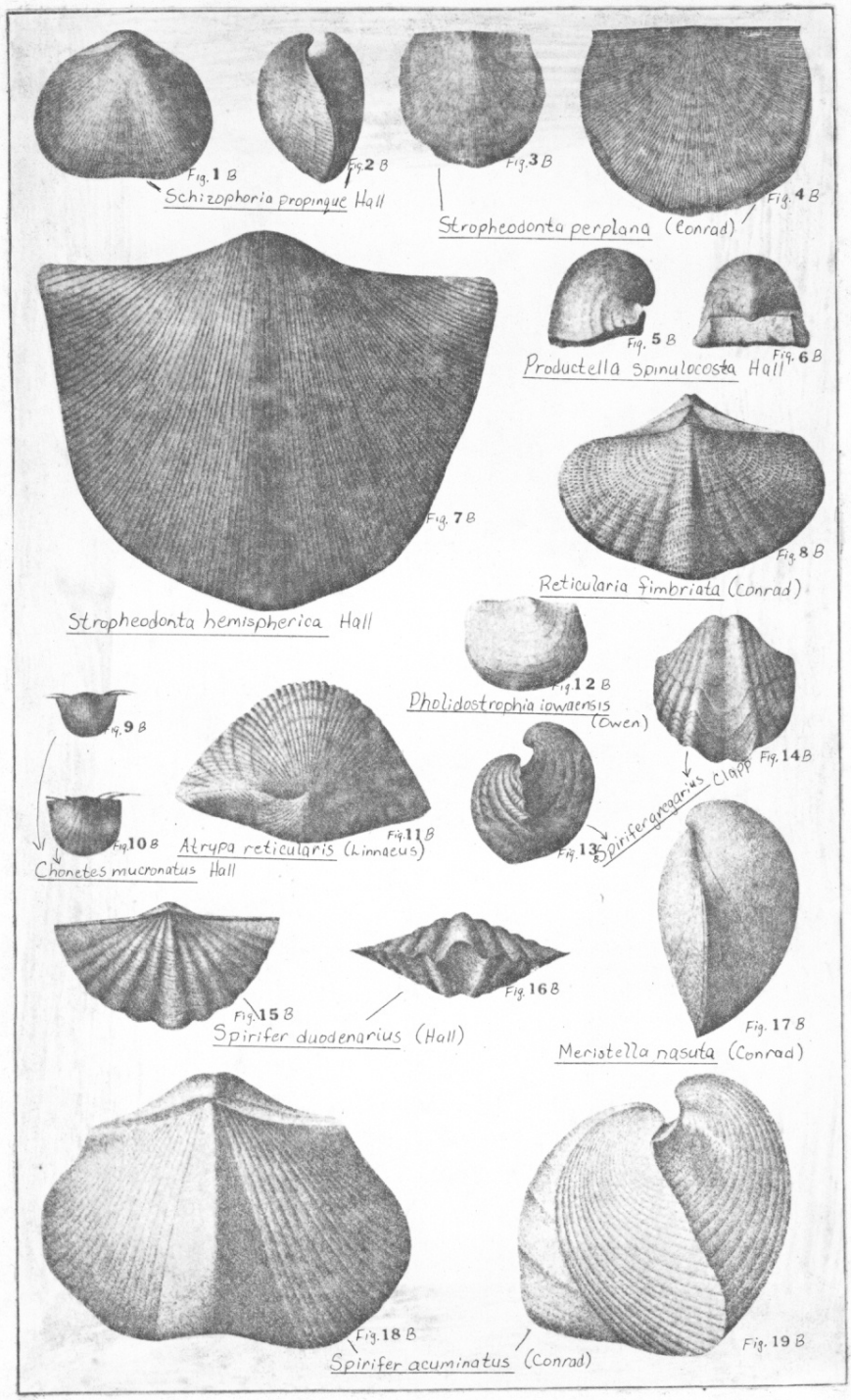


FIG. No. 6 COLUMBUS LIMESTONE FOSSILS (cont'd)

figures 1B-19B are brachiopods.

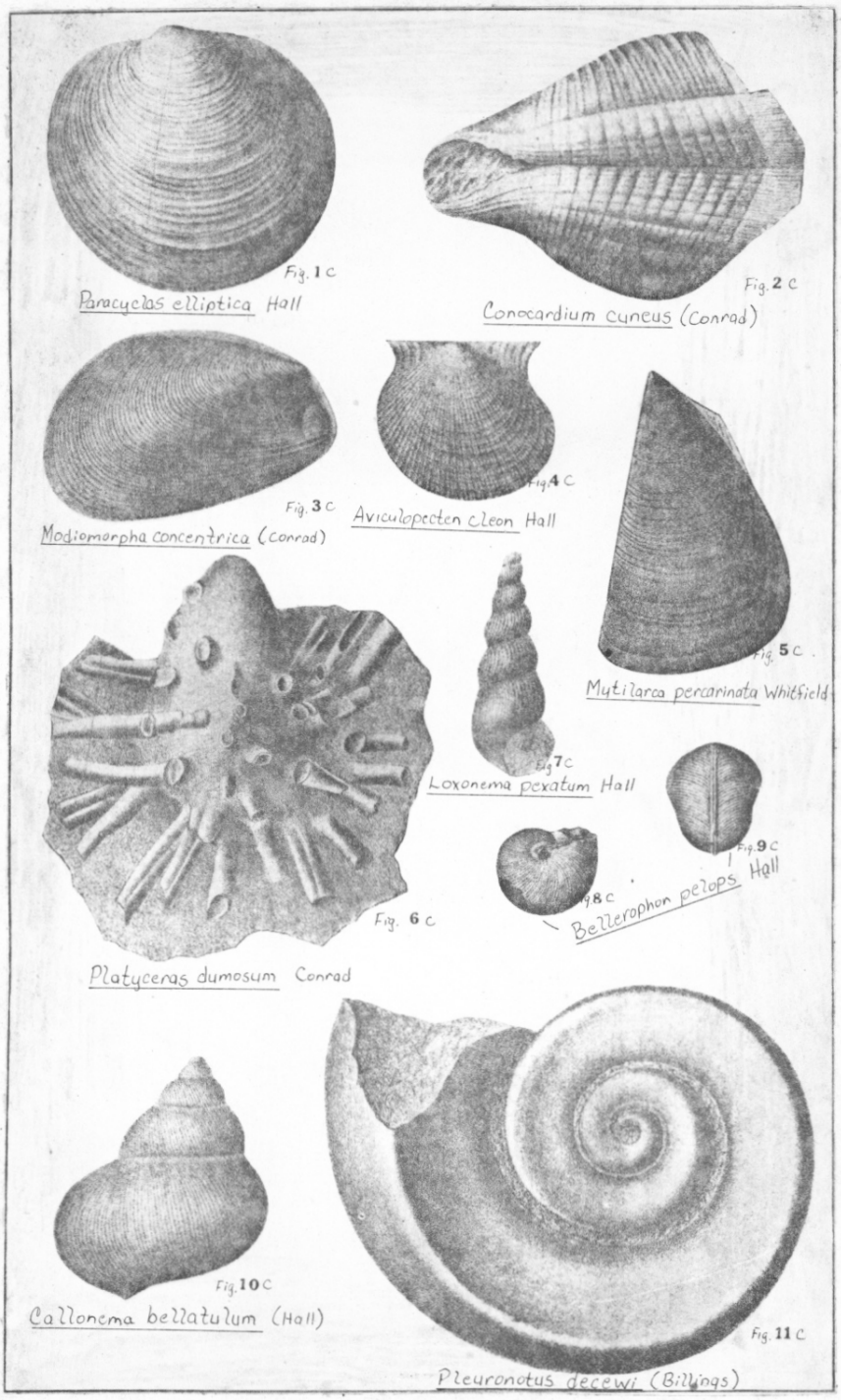


FIG. No. 7 COLUMBUS LIMESTONE FOSSILS (cont'd)

Figures 1c - 5c are pelecypods and figures 6c - 11c are gastropods.

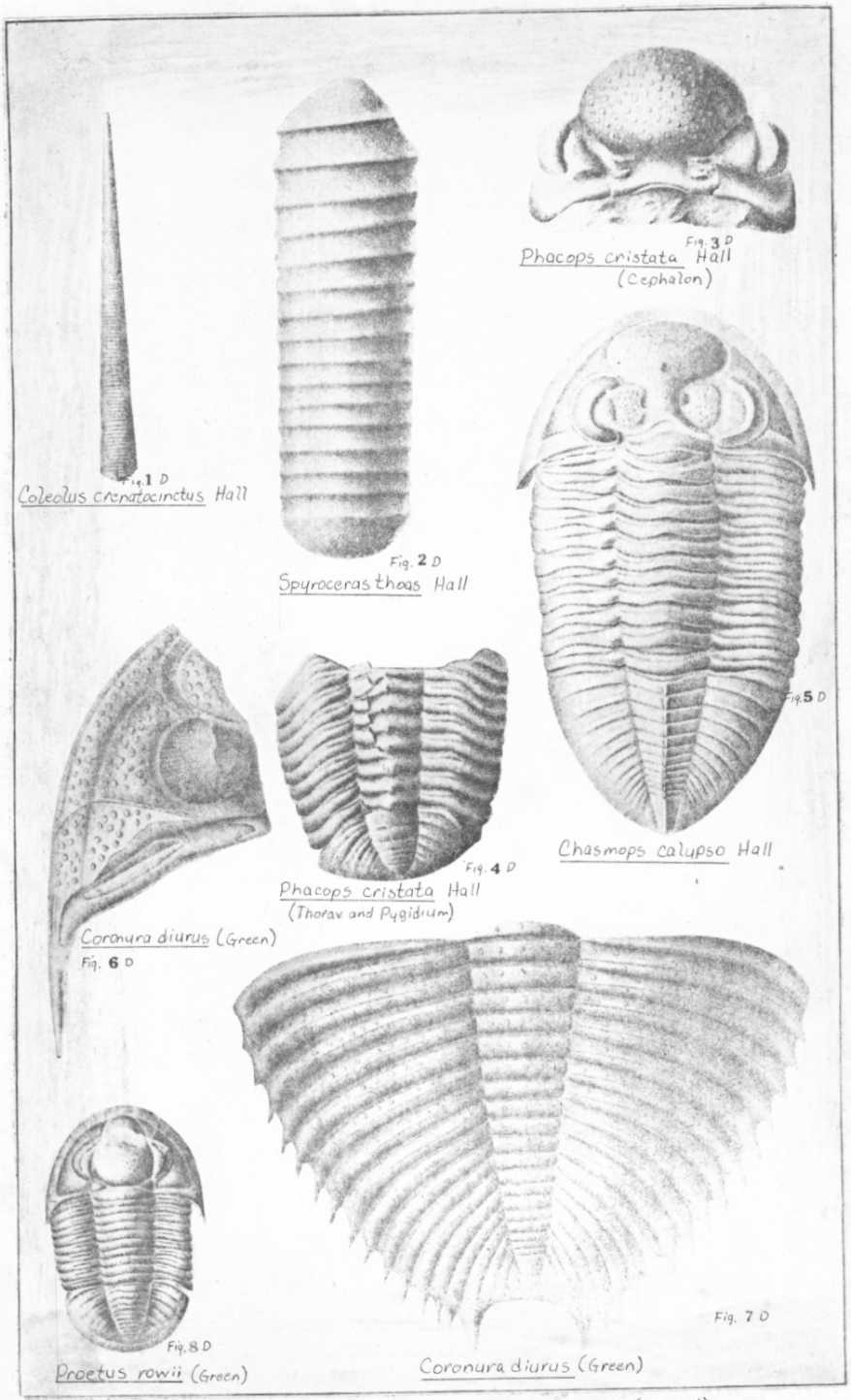


FIG. No. 8 COLUMBUS LIMESTONE FOSSILS (cont'd)

Figure 1D is a pteropod, 2D a cephalopod and 3D-8D are crustaceans (trilobites)

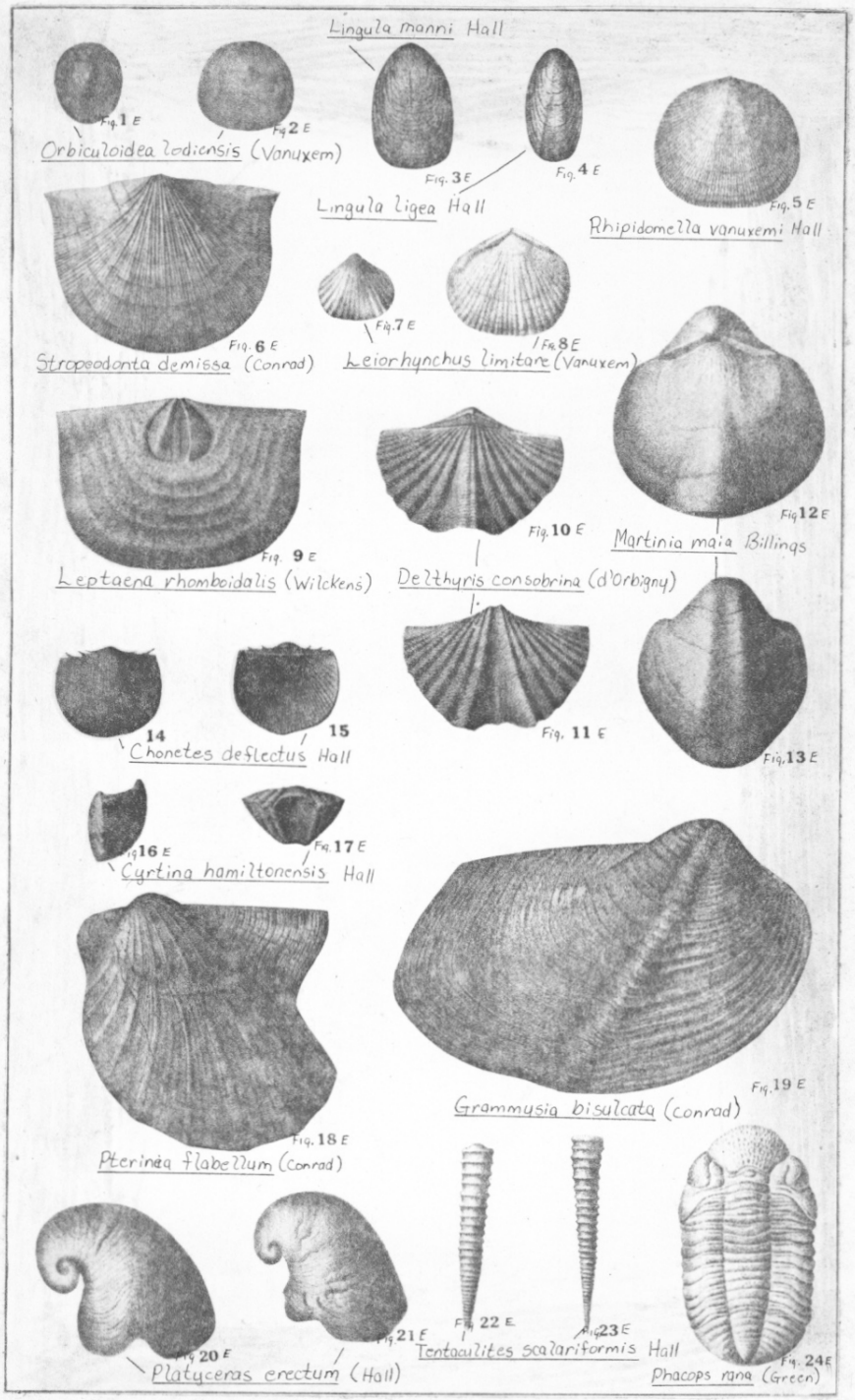


FIG. NO. 9 DELAWARE LIMESTONE FOSSILS

Figures 1E-17E are brachiopods, 18E-19E are pelecypods, 20E-21E is a gastropod, 22E-23E are pteropods, 24E is a crustacean (trilobite), and 25E-26E are two views of the "button coral".

Fig. 24E CRUSTACEAN (Trilobite)

Figs. 25E-26E CORAL ("BUTTON CORAL")

COLLECTING LOCALITIES

Historically, the best fossil collecting localities have been stone quarries. Few other places offer such relative ease of access to the fossil-fancier. However, recent government safety regulations have all but closed this avenue of discovery to the collector. One limestone quarry in Ohio was recently fined twenty thousand dollars for admitting a class of twenty students into its works. Since then, nearly all quarry operators have taken the hint. The result is that we are forced to examine roadcuts, streams and bluffs for collectables. Several of the small stream inlets to the Scioto and Olentangy Rivers offer favorable collecting, although access may be a problem. Hayden Run, north of Henderson Road in Columbus remains a productive locality for brachiopods, corals, gastropods and cephalopods as does the O'Shaughnessy Dam region near the Columbus Zoo, about one-half mile north of the Franklin-Delaware County line. Some good specimens may also be found on the limestone slabs which adorn the Hoover Dam in northeast Franklin County, just south of the Franklin-Delaware County line (Fig. 1).

GLACIAL HISTORY

It is generally held that the central Ohio region was one of relatively low relief prior to the coming of the first glaciers. This was a heavily wooded area with gently rolling hills. Drainage was to the northwest and was accomplished by the huge Teays River System.

There were four ice invasions into Ohio during the Pleistocene, an epoch of geologic time encompassing the interval between about 2.5 million and 5 thousand years ago. Each glacial advance was interrupted by a warmer period known as an interglaciation. During the Pleistocene as much as two-thirds of Ohio had been covered with sheets of ice as much as one mile thick.

Many species of plants such as spruce, fir, tamarack, cedar, hemlock and larch were common during the Pleistocene in Ohio. Animal life included the mammoth, mastodon, musk-ox, reindeer, ground sloth, giant beaver and wild horse (Hansen, 1974). All of these animals are either extinct or no longer present in Ohio.

In the classical system, the first ice advance in North America is known as the Nebraskan, but no proof of its appearance in Ohio has ever been discovered. The first undisputable advance in Ohio then, was the Kansan (Fig. 10). It moved into the state one million years ago altering the topography and forcing changes in drainage. The most significant drainage reversal caused by Kansan glaciation was the one imposed on the ancient Teays River. The Teays was the major drainage system in the state having its origin in Virginia and flowing from southern Ohio, near Ports-

mouth, then arching northwestward through Ohio before continuing west across Indiana and Illinois to meet the Mississippi. The river became choked with fine silt and glacial outwash. The river spilled over its banks and the direction of flow was reversed from northwest to south. The furthest southeastward advance of Kansan ice is believed to be the northwest half of Franklin County (Harper, 1948).

Following a warm interglaciation, the second glacier entered the state. This was the Illinoian glaciation which occurred 350,000 years ago. Its southward and eastward advance surpassed all others, before or after it (Fig. 10). Most evidences of previous glaciation in Franklin County were obliterated.

The third and last ice advance into Ohio was the Wisconsin. It entered the state about 125,000 years ago and retreated about 14,000 years ago. These glacial deposits are well preserved due to the short amount of time erosion has had to act on these sediments since their deposition. As can be seen from Figure 11, Franklin County lies almost entirely upon Wisconsin age ground moraine, between two major belts of end moraine to the north and south, and a minor one to the east. By far the largest of these is the Powell moraine to the north. It extends clear through Union County to the west and as far north as Richland County, some fifty miles away. This moraine is seldom less than one mile in width and frequently exceeds two miles. It slopes gently northward but presents a rather imposing south-facing front. The slope to the north is generally less than one degree.

GLACIAL FEATURES OF FRANKLIN COUNTY

About four or five miles south of Columbus appear some of the better kames to be seen in the county. The area is called Spangler Hill (Fig. 1) and consists of about twenty or more gravel hills rising from a couple of feet to some 60 or 70 feet above the surrounding till plain (Stauffer et al., 1911). Stauffer tells us of an esker in Columbus located at 16th Avenue between Summit Street and Indianola Avenue, about one-half mile east of the campus of Ohio State University. This esker appears on the map accompanying his report, however no trace of it presently exists as it has been destroyed by urban development since that time.

The glaciers scraped up huge boulders from the earth and deposited them haphazardly over the landscape throughout Franklin County. These "erratics" are as large as several feet in diameter and appear either in small groups or individually. Truly, they seem out of place and serve as a vivid reminder of our not-too-distant glacial past.

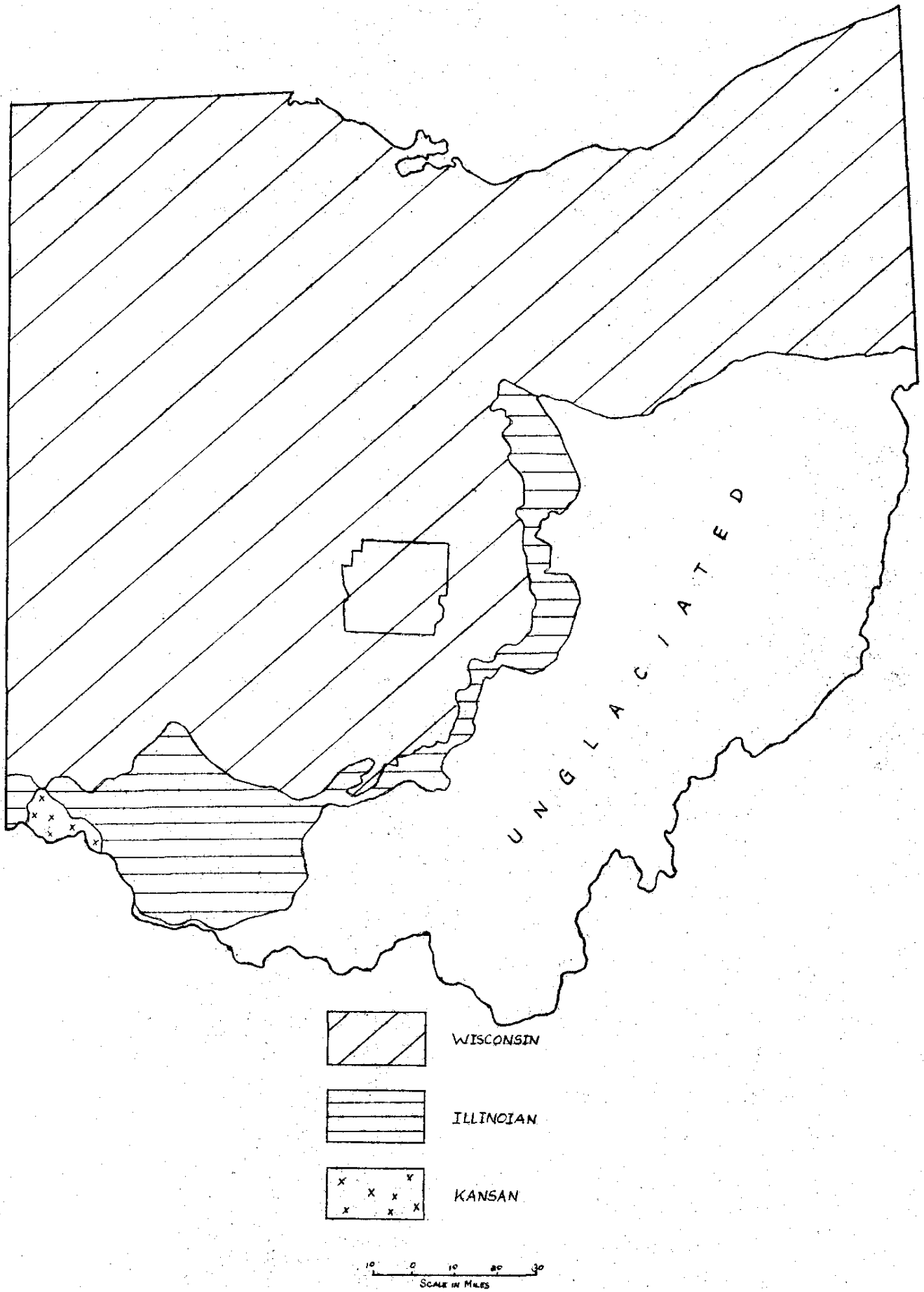


FIG. NO. 10 MAP SHOWING FURTHEST ADVANCE OF OHIO'S GLACIERS
(FROM O.D.N.R. EDUC. LEAFLET NO. 7 HANSEN 1974)

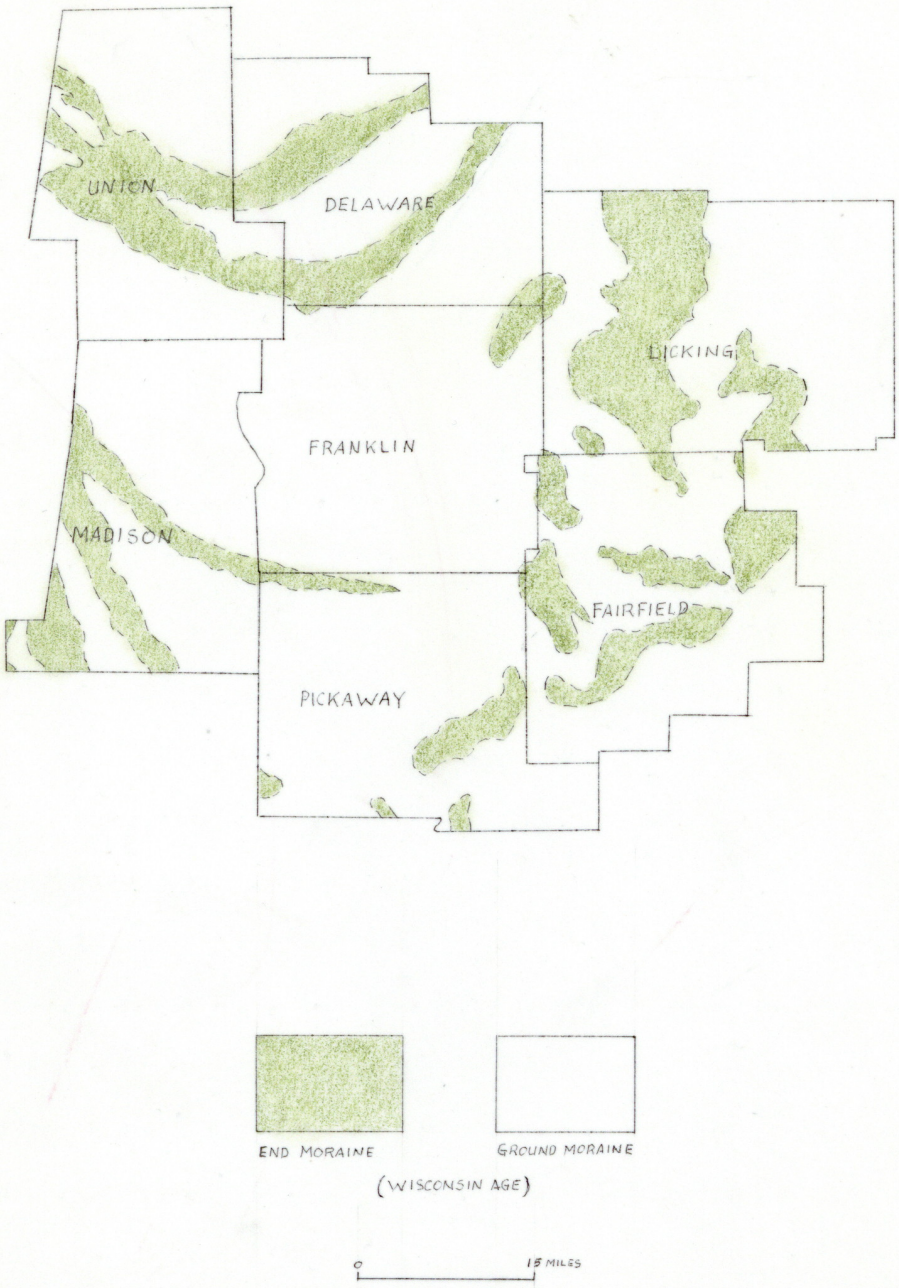


FIGURE NO. 11 MORAINE DISTRIBUTION ABOUT FRANKLIN AND NEIGHBORING COUNTIES
(AFTER O.D.N.R. EDUC. LEAFLET NO. 7 "OHIO'S GLACIERS", 1974)

ENVIRONMENTAL GEOLOGY

WATER RESOURCES

Climate

Central Ohio climate has been classified as "humid continental with hot summers and cold winters" (Anderson et al., 1976). The total average annual precipitation over Franklin County is about thirty-seven inches. Snowfall averages around twenty-three inches per year, but may fluctuate greatly from year to year.

Figure 12 represents a generalized water budget for central Ohio. Although the average rainfall for Franklin County is slightly less than the value given in the figure, it still serves as an adequate model to illustrate the relative distribution of available precipitation for this area. There are many variables which must be taken into account when one considers the construction of a water budget model for a specific area. These include topography, soil permeability and the degree to which the area is urbanized.

Much less water is available to ground water replenishment over large residential areas as opposed to agricultural or non-developed areas. Franklin County ranks high among the most urbanized counties in Ohio. With urbanization comes buildings, residential streets, and highways, all impermeable surfaces. Surface water is channeled away to enter city sewers and eventually the many rivers and small streams. The effect that urbanization has on an area's natural drainage has been referred to as the "umbrella effect". Continued disturbance of natural

drainage and soil absorption necessitates more stream and flood control management. Disturbance of natural drainage in urbanized areas tends to multiply because, as a rule, land given to urbanization is permanently lost to agriculture and cities continue to grow and expand, they do not shrink.

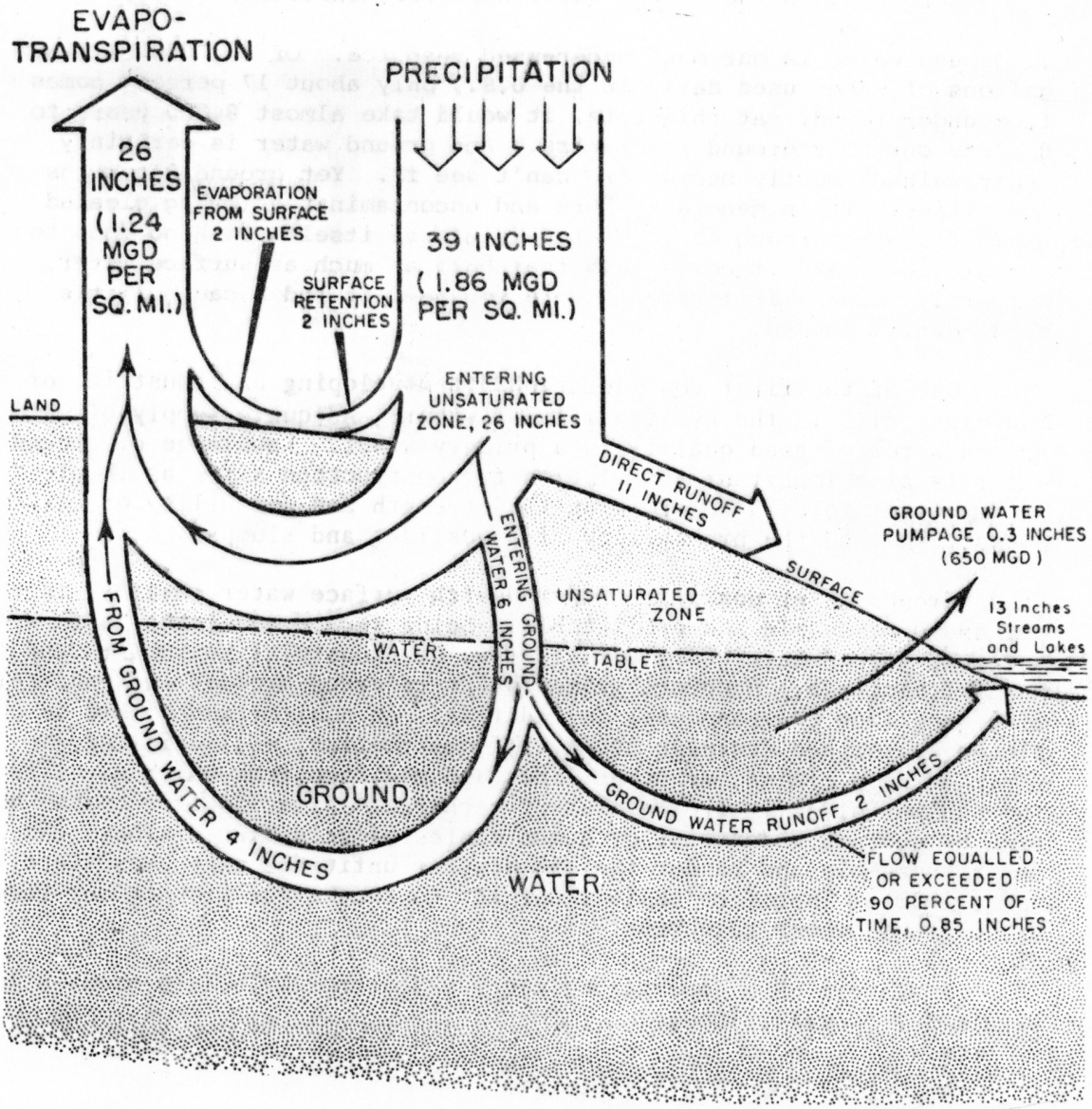


FIGURE NO. 12 GENERALIZED WATER BUDGET FOR OHIO

(PHOTOCOPY PAGE 5-2 ENVIRONMENTAL ANALYSIS OF CENTRAL OHIO, ANDERSON AND KING 1976)

Surface Water

Drainage in Franklin County is predominantly to the south. The Scioto and Olentangy Rivers became the main drainage outlet for Wisconsin Age glacial meltwater and remain the major streams in the central Ohio region since that time. Toward the southwestern part of the county, the Darby Creek handles most of the drainage while to the east it is the Alum-Big Walnut-Blacklick System, which eventually merge and join the Scioto River just south of the Franklin-Pickaway County line.

The river systems in Franklin County exhibit the most consistently uniform and parallel drainage to be found among most other counties in the state.

Ground Water

Ground water is water which is found below the earth's surface instead of lying upon it. It is that water which has seeped down through the soil and rock and collected in pore spaces. It is generally quite pure as it is filtered naturally through the earth. Being below the surface, it is not so commonly contaminated with industrial waste, though this still can occur.

About 17% of all water used in Ohio is ground water. Comparing the current usage rate against existing supplies, it is estimated that 8,000 years could elapse before sufficiently depleting the supply (Ohio Div. Geol. Surv. leaflet "What's Ground Water?"). The cost of obtaining it is relatively small as it occurs nearly everywhere it might be needed, and not at great depth in central Ohio.

The amount of ground water in a particular area is an important factor in determining the strength of soil foundations, that is, in determining the probability of landslides or slumps.

The high humidity and abundant rainfall in Franklin County provide for sufficient replenishment of the ground water supply such that great quantities may be removed with little or no net lowering of the water table.

The principal water-bearing strata in the county are the Columbus and Delaware Limestones, and the Olentangy and Ohio Shales.

The occurrence of ground water in drift-covered areas like Franklin County varies as soil textures change rapidly. Limestone underlying the

western half of the county provides for the storage of great quantities of water, as it is quite porous, well cracked and jointed. On the other hand, the shales are fine grained and less porous, so they tend to trap less ground water. The chemical action of water on iron pyrites contained within the shales can release the unpleasant smell of hydrogen sulfide. Such has been the case with water obtained from the Ohio Shales.

Perhaps more important than bedrock are the surficial glacial deposits. Ancient stream valleys buried beneath till or alluvium make excellent aquifers as their permeability allows for great accumulations of ground water in these natural reservoirs. Ground and terminal moraine deposits, as well as kames and eskers are capable of holding much water.

Outwash gravels of the Scioto and Ohio Rivers have been known to produce as much as 500 to 1,200 gallons of water per minute.

(Ohio is one of the few states that has been extensively mapped for ground water availability.)

Figure 13 shows the relative abundance of ground water throughout Franklin County. The dark blue areas contain enough ground water to supply municipal, industrial and irrigation needs. As the figure illustrates, we are well endowed with this valuable resource in most parts of the county.

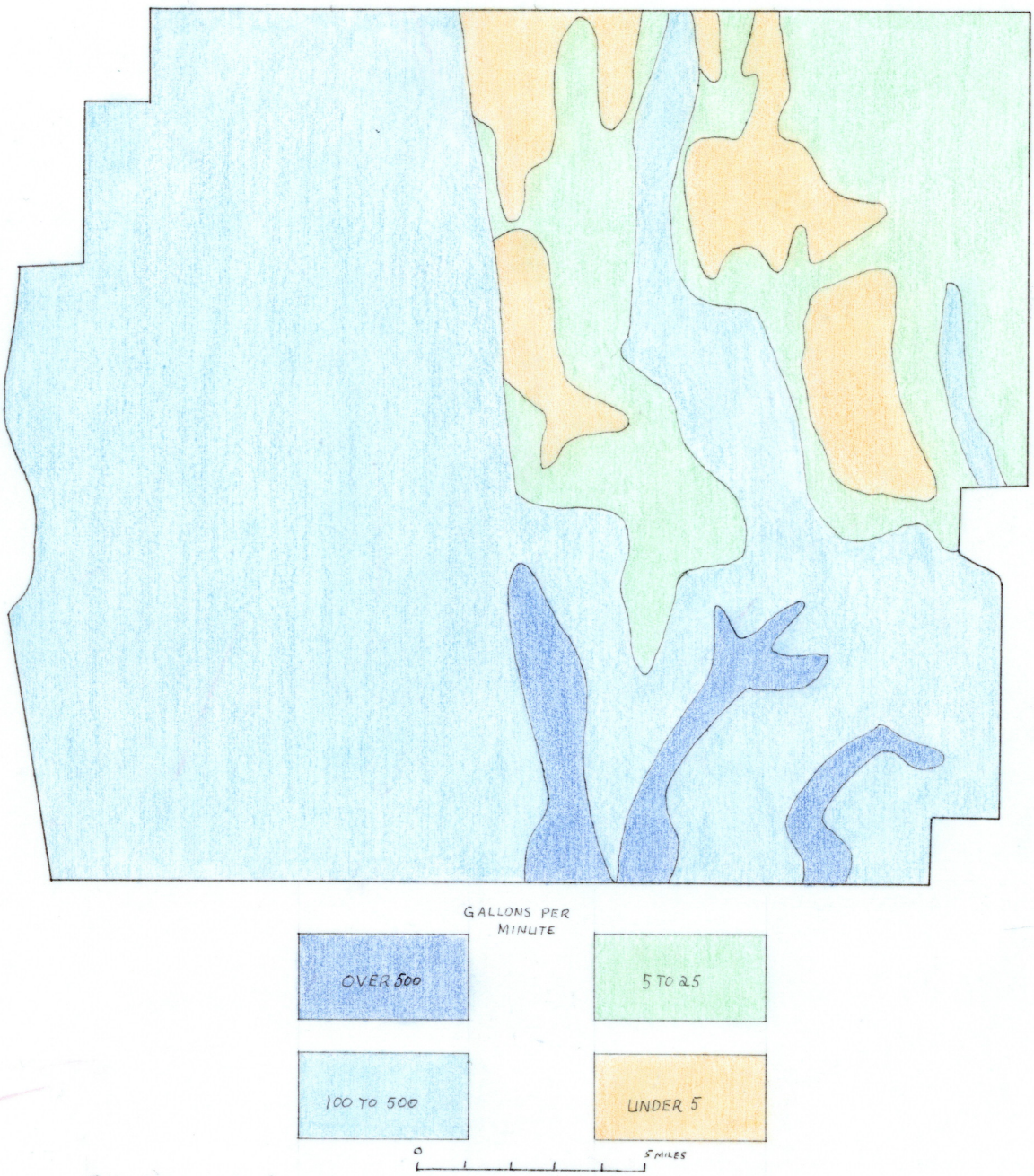


FIGURE NO. 13. GROUND WATER YIELDS IN FRANKLIN COUNTY
(AFTER O.D.N.R. EDUC. LEAFLET "WHAT'S GROUND WATER?")

Ground Water Heat

The earth acts as an insulator against both heat and cold. Therefore, ground water contained within maintains a fairly constant temperature, respective of depth and mean annual temperature across the region being considered.

The U. S. Department of Energy has recently completed a heat pump study. From this came forth a map of U. S. ground water temperatures recorded from wells between 50 and 150 feet in depth. This map is believed to be the first such effort of its kind. Figure 14 has been taken from that map and enlarged to show the distribution of ground water heat throughout Ohio and Franklin County. Ground water temperatures appear to increase gradually across the state from northeast to southwest. Several elongate pockets of similar temperature, like the one shown in the southwest corner of Ohio, are not unusual and occur in several other states throughout the country.

Ground water temperatures in Ohio at the depths specified range from 52 to 58 degrees farenheit. By contrast, ground water temperatures through Texas vary from 59 to 80 while those of North Dakota range from 43 to 46 degrees. So Ohio stands comfortably intermediate between these extremes.

FIGURE NO. 14 GROUND WATER TEMPERATURES (F°) THROUGHOUT OHIO IN WELLS RANGING FROM 50' TO 150' IN DEPTH (FROM WATER WELL JOURNAL SEPT., 1979)

SOIL RESOURCES

Introduction

The fertile, nutrient-rich soils of Franklin County are one of her most valuable natural resources. In part, glaciation is responsible for this. But this area has been thickly vegetated for ages thus making the soil rich in organic matter and so favorable for the growing of crops. Present ground cover acts as a tremendous deterrent to the processes of erosion, as does the low relief. This section examines some of the different soil types and characteristics which help make this region the agricultural success that it is, as well as some of the hazards and precautions which must be considered when determining the developmental potential of the land.

The soils of Franklin County exhibit many common characteristics. Most were formed above glacial till, sand or gravel, which shouldn't be surprising as the entire county lies upon glacial ground moraine. Due to the most recent glaciation, relief over the entire area is low with broad, flat areas and gentle sloping hills. Therefore, surface and subsurface drainage is minimized and the water table remains high in many areas. A high water table coupled with the slow permeability of many soils helps to increase the occurrence of local flooding in early spring and winter. The darker soils appear as they do because of their high organic content, which makes them nutrient rich and very productive agriculturally.

In unglaciated areas, the soils are expected to be of a similar composition to the bedrock below, from which they formed. Though glaciated, this

is still the case in Franklin County. As bedrock generally outcrops in north-south trending belts across Ohio and the glaciers moved from north to south paralleling the outcrop pattern, one still finds soils which are similar in composition to the underlying bedrock. Since the majority of exposed bedrock in Franklin County consists of Devonian limestones and dolomites, it should not be surprising that the soils of Franklin County are, as a whole, somewhat limey.

Flood Plain Soils

Flood plain soils are an important constituent of the soil resources of this area. Rich soils from upland areas are transported downslope, by the processes of erosion, and are washed into the drainage systems of many streams. When they overflow their banks or change course by shifting laterally, this material is deposited on the flood plains. Deposition in this way provides for broad, flat areas of soil accumulation. These soils are nutrient-rich and are therefore utilized agriculturally.

But these areas are susceptible to seasonal flooding. Early flooding can greatly delay spring planting, which of course can affect fall yields. Many other hazards, including damage to homes and septic tanks, can occur in both winter and spring in these flood-prone areas.

The most extensive area of flood plain soil deposition in Franklin County is found at the intersection of the Olentangy and Scioto Rivers near the west side of Columbus.

A portion of the campus of Ohio State University lies essentially on the flood plain of the Olentangy, some 2.5 miles north of the "intersection". This became evident during a period of exceptionally heavy rainfall in October of this year when kayaking replaced football and soccer practice as the main event on the University practice fields. Though the river did not actually overflow its banks, this attests to the poor drainage afforded by the total lack of topographic relief in flood plain areas. Table 2 gives the drainage categories for some of the major soil associations found in Franklin County.

TABLE 2

SOIL DRAINAGE TERMINOLOGY

(The following taken directly from P.R. #50)

Very Poorly Drained - Water is removed from the soil so slowly that the water table remains at or near the surface the greater part of the year. Soils of this class usually occupy level or depressional sites and many of them are frequently ponded.

Poorly Drained - Water is removed from the soil so slowly that it remains wet for long periods of time. The water table is commonly at or near the surface during a considerable part of the year.

Somewhat Poorly Drained - Water is removed from the soil somewhat slowly so that it remains wet for significant periods, but not all of the time. Somewhat poorly drained soils commonly have a slowly permeable layer within the profile, a high water table, additions through seepage or a combination of these conditions.

Moderately Well Drained - Water is removed from the soil somewhat slowly so that the profile is wet for a small part of the time. Moderately well drained soils commonly have a slowly permeable layer within or immediately beneath the surface soil and subsoil layers, a relatively high water table, additions of water through seepage or some combination of these conditions.

Well Drained - Water is removed from the soil readily, but not rapidly. Well drained soils are commonly intermediate in texture, although soils of other textures may also be well drained. A well drained soil has "good" drainage.

Soil Associations in Franklin County

A soil association is "a group of defined and described soils occurring together in an individual and characteristic pattern over a geographic region" (McLoda, 1977).

There are ten soil associations in Franklin County. Only the major ones, in terms of geographical extent, are summarized here and are represented in Fig. 15.

[The summary of soils below is from McLoda (1977).]

Medway Genesee: This association is found in long, narrow areas along major rivers and streams in the county. These include the Scioto and Olentangy Rivers, Darby and Big Walnut Creeks. These soils formed in loamy (mixture of clay, silt, sand and organic matter) alluvium that had been deposited in times of flood. Therefore they are found near the stream channel and on the natural levee. The Medway soils are darker in color and moderately well drained in contrast with the lighter, well drained Genesee soils. Most of this association has been developed agriculturally. Some areas have been utilized for recreation. Soils of this association make good topsoil and are mined to a small extent. In Columbus, most of this association has been developed non-agriculturally, however it is subject to seasonal flooding in early spring and winter. Care must be taken when considering developmental potential in these areas. This association can be utilized favorably for cropland and pastureland as well as natural area development, but the flooding hazard places strict limitations on the non-farm development.

Eldean-Ockley-Warsaw: The soils of this association occupy high terraces along major streams. The landscape is typically broad and nearly level. These soils are all well drained and formed in silty or loamy material occurring above glacial outwash sand and gravel. The generally darker Warsaw soils are readily visible in cultivated areas. Uses for soils of this association include the growing of grain, fruits, vegetables, mining of topsoil and mining of sand and gravel from the underlying glacial deposits. Because of the natural good drainage, these soils impose a slight limitation on farm development, however they can be successfully irrigated. Flooding rarely, if ever, occurs on these high terraces, but the soils are subject to erosion in areas of slightly greater slope.

Bennington-Pewamo: The soils of the Bennington-Pewamo occupy nearly the entire northeastern quadrant of the county, and comprise one of its largest soil associations. The landscape occupied by these soils is characterized by broad, flat areas with depressions and scattered areas of gently sloping hills. They formed in areas of clay-loam glacial till with a moderate lime content. Bennington soils are somewhat poorly drained and are lighter in color. About 70% of the land covered by this association has been developed for residential or commercial use. The rest is utilized agriculturally. Seasonal wetness is a major land use limitation. Ponding in depressional areas can occur over long periods of time during excessive rainfall. Surface water runoff is inhibited by the nearly level landscape. Slow permeability and poor surface drainage

impose severe problems for septic tank absorption fields as well as residential developments.

Crosby-Brookston-Kendallville: This association occurs on nearly level to gently sloping to sloping knolls and ridges. Soils of the Crosby-Brookston-Kendallville occupy the southeastern part of Franklin County.

The Crosby and Brookston soils formed in loamy glacial till with a high lime content. Kendallville soils formed in a thin layer of gravelly material overlying glacial till. Crosby soils are somewhat poorly drained, Brookston very poorly drained and Kendallville well drained. Brookston soils are much darker in color and provide for a striking landscape pattern in cultivated areas. Most of this association is utilized for cash grain crops and is very productive. Dairy and livestock farming are important in these areas. Much of the association is used in the sod and nursery industries also. Suburban development covers only about 25% of these areas. Seasonal wetness is the limiting factor for further suburban development. Erosion on areas of greater slope is another factor. Slow permeability on Crosby soils can make them unsuitable for use as septic tank absorption fields.

Crosby-Brookston: This association occupies a large area of the basically flat part of western Franklin County. The landscape is typified by nearly level and gently sloping knolls and ridges. Darker colored Brookston soils provide for a conspicuous landscape pattern in cultivated areas. These soils formed in loam glacial till with a high lime content. Crosby soils are

somewhat poorly drained, Brookston soils very poorly drained. This association is used primarily for the growing of cash grain crops. About 30% of the Crosby-Brookston is utilized non-agriculturally. Seasonal wetness and ponding impose major limitations. These soils can be effectively drained but finding outlets for such can be locally difficult due to the nearly level topography. Again, slow permeability imposes limitations on septic tank absorption fields.

Brookston-Crosby-Lewisburg: These soils occupy a large, relatively narrow strip of land in western Franklin County. The landscape is composed of broad flats and depressions intermingled with gently sloping knolls and ridges. These soils also formed in loam glacial till with a high lime content.

Brookston soils are dark colored and very poorly drained. The Crosby and Lewisburg soils are somewhat poorly drained and well drained respectively. The majority of this soil association is used for growing cash grain crops like corn and soybeans. As is the case with other associations mentioned, ponding and drainage present strict limitations on land use, and these soils may not be suitable for septic tank absorption fields.

SOIL ASSOCIATION

MEDWAY-GENESEE

ELDEAN-OCKLEY-WARSAW

BENNINGTON-PEWAMO

CROSBY-BROOKSTON-KENDALLVILLE

CROSBY-BROOKSTON

BROOKSTON-CROSBY-LEWISBURG

FIG. NO. 15 SOIL MAP OF FRANKLIN COUNTY (BOUNDARIES ROUGHLY LOCATED) [AFTER McLODA, ET AL. 1977]
(SOME MINOR SOIL ASSOCIATIONS HAVE BEEN IGNORED)

ECONOMIC GEOLOGY

The most valuable of Franklin County's natural resources is its fertile soil, discussed previously. Ranking second would be either ground water or limestone. Following is a list of economic utility of the rocks exposed in the county, beginning with the oldest. [The following is from Stauffer et al., (1911).]

ECONOMIC VALUE OF EACH FORMATION

Monroe Formation: (Bass Island Group undifferentiated) - this limestone is relatively impure, unattractive and has no real economic value in the county.

Columbus Limestone: This remains one of the most important limestones in the state. It is relatively unattractive in appearance but is quite pure and very strong. It has been and still is a fine source of building stone. This limestone has been valuable in the making of roads, sidewalks, concrete, lime, fertilizer and in the manufacture of glass and soda ash. It used to be crushed and used as railroad ballast and was also used as flux.

Many early homes of the area were built with Columbus Limestone as well as the State House and Judiciary Building.

Another great demand of the Columbus Limestone has been in making pig iron. It was especially suitable for this as it is low in sulphur, silica and phosphorous, which makes iron brittle.

Delaware Formation: The Delaware near Columbus is really only a series of shales. These shale layers had to be removed to reach the more

valuable Columbus Limestone below and were frequently simply crushed and used as ballast. Both the Columbus and Delaware Formations had been mined in Marion Township for use in making concrete and road metal.

Olentangy and Ohio Shales: The rock of these formations has not been very valuable but has found some employment in making bricks, drain tile and sewer pipe, and common clay products.

Bedford Shale: The Bedford Shale is mined in Jefferson Township and is used in the making of bricks and drain tile. It is also utilized in the ceramic industry.

Berea Sandstone: This formation is also of minor economic value but was used somewhat for building stone near Gahanna.

Sunbury Shale: The Sunbury has been of little or no economic importance, except in the making of common clay products.

Cuyahoga Formation: The sandstones of the Cuyahoga were used as building stone for the Institution for the Blind in Columbus, but is of little economic value.

Glacial Drift: Glacial drift is a very important source of sand and gravel in the county. This material has also been used in the making of bricks and drain tile over a wide area.

OTHER RESOURCES

Search for Oil and Gas

The search for oil and natural gas in Franklin County has been an exercise in futility.

The discovery of natural gas in the Trenton Limestone near Findlay, Ohio in 1884 and of oil a year later sparked interest in drilling in other parts of the state. In 1886 a well was sunk in the valley of the Olentangy River in Columbus but came up dry. The well reached the top of the Trenton at a depth of 1,915 feet and drilling ceased at 2,020 feet.

Another well was sunk in the county in 1891. The Trenton was reached at 2,027 feet, but failed to produce oil or natural gas.
Somewhere between 1857 and 1860 a well was sunk on the State House grounds in hopes of obtaining drinking water for the Capitol Building. At a depth of 187 feet, the well encountered sulphur water and at 675 feet, brine. The Trenton here was shown to be 475 feet thick but yielded no oil or gas either.

A well drilled at the Hartman Farm reached the unusual depth of 3,100 feet but also proved a failure.

The well records have been lost, but attempts were also made in nearby Canal Winchester, Sunbury and Westerville, all of which were failures.

Several more attempts have been made since the turn of the century to find oil and gas in Franklin County without success. The reason for such repeated failure to obtain natural fuels in the Trenton in central Ohio remains a mystery, even though this formation was so productive in northwestern Ohio.

The abundance of coal in Franklin County is such as to make its mining not economically feasible. No coal mining has ever been done in Franklin County. However, coal is mined in great quantities in eastern and northeastern Ohio in the rocks of Pennsylvanian Age.

(The following figures on production of mineral resources are from the 1977 Division of Mines Report.)

Shale

Of the twenty-one shale producing counties in the state, Franklin County ranks tenth with 46,975 short tons, all of which was used in the ceramic industry.

Sand and Gravel

In 1977, sixty-seven counties reported sand and gravel production. Franklin County ranked fourth behind Hamilton, Butler and Portage counties.

In that year, 996,629 tons of sand were quarried in this county. About 35% of this was used for making building material, but the majority was used for paving.

The 1977 total represents a decrease of 42% from the year 1963 when sand production exceeded 1.5 million tons.

The gravel production figure for 1977 was over 1.5 million tons, a decrease of over 54% from 1963 when gravel production exceeded 3.3 million tons.

Flint

In 1965 the Ohio General Assembly designated flint as the official gemstone of the state. Flint is a form of silica (SiO_2) and therefore quite durable. Its relative abundance, beauty, durability and service to early man made it the obvious choice. It can be very colorful and, with some effort, fashioned into arrowheads, scrapers and other implements. Flint's ability to take and retain a high polish makes it attractive to the collector and jewelry maker.

Northeast of Columbus in neighboring Licking County, is found a most notable occurrence of the gemstone. A narrow band just east of Newark almost to Zanesville has come to be named Flint Ridge. From the Vanport member of the Pennsylvanian age Allegheny Formation can be collected many colors of flint: blue, yellow, pink, green, red, white and black. This variety of colors in such abundance can be found nowhere else in the state. The occurrence of flint here is one to five feet thick and exposed directly at the surface. This was an area of special significance to the several different groups of native-Americans who collected it some 11,000 years ago. Perhaps it was delegated as neutral territory as no evidence of battle has ever been discovered at Flint Ridge.

Flint is not poorly represented in Franklin County. Much of it is found in the Delaware Formation along the bluffs of the Scioto River from Columbus to the Franklin-Delaware County line. It occurs locally but abundantly in small bands or nodules generally somewhat darker in

color, brownish-black to black. Although not as outstanding an occurrence as Flint Ridge, this area must still have been a valuable collecting locality for the early toolmakers. It has been shown that these darker varieties would have been more favorable as they could produce a sharper edge when fashioned, but the lack of color made it less pleasing to the eye and thus less feverishly collected.

PLACES TO SEE

For those interested in the local geology, a trip to Columbus should include visits to the Orton Museum on the campus of the Ohio State University and the Ohio Historical Society's Museum at I-71 South and 17th Ave.

The Orton Museum is located in Orton Hall on the south campus. The museum was first opened in 1892 and dedicated to Edward Orton.

Here can be found a good representative collection of fossils, gathered both locally and from around the state. The number of specimens on hand totals in the hundreds of thousands, however most are utilized as tools of scientific study rather than display items. The museum owns fossil remains of some reptiles of Jurassic age collected from the famous Solnhofen locality in Germany. However, the collection of invertebrates far outnumbers the vertebrates. Also to be found in the museum are one-foot-long trilobite specimens of the genus, Isotellus.

The museum of the Ohio Historical Society offers some fine displays of Ohio's rocks and minerals, and fossil plants and animals. Of this latter group, at least two specimens are outstanding and worthy of mention.

One of these is the Conway Mastodon. It was discovered in 1894 in Clark County beneath four feet of swampy ground. The fossil remains were donated to O.S.U.'s Orton Museum by N. S. Conway and have been on loan to the Ohio Historical Society since 1970. Reconstruction of the mastodon showed that it stood ten-feet two-inches high with tusks

weighing over one hundred pounds apiece. It is, of course, of Pleistocene age and was found in a state of excellent preservation.

The second specimen worthy of note is Jefferson's Giant Sloth. It was discovered in Holmes County in December of 1890 and donated to the Orton Museum in 1895 by Emerson McMillan. It is now on display at the Society for a two-year period. This individual stood seven-feet three-inches high and is the only specimen ever found that far north.

SUGGESTIONS FOR FURTHER READING

The reader may wish to refer to certain listings in the bibliography for more detailed information regarding the topics discussed in this report.

Stauffer, Hubbard and Bownocker's 1911 report entitled The Geology of the Columbus Quadrangle gives a good general overview of the geology of this area. It is especially useful to those interested in the bedrock and glacial aspects of the geology. This book gives some of the more representative fossils found in each outcropping formation, but Stauffer's 1909 report (not listed) delves more deeply into the fossils of the Devonian.

The Ohio Department of Natural Resources publishes several excellent first references to ground water, Ohio's glaciers, fossils, mineral resources and several other topics. The staff of its Division of Geological Survey stands ready and anxious to answer questions regarding those areas of interest which are not so easily researched.

Also highly recommended are "An Inventory of Ohio Soils: Franklin County", available free of charge from the Division of Lands and Soils, and for a more detailed account of the climatic and environmental aspects, "Environmental Analysis of Central Ohio" by Anderson and King.

A report on the water quality in Ohio has recently been completed by Pettyjohn, et al., (1979) and the reader is encouraged to refer to that paper for further information.

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